

# **NASA Earth Observatory**

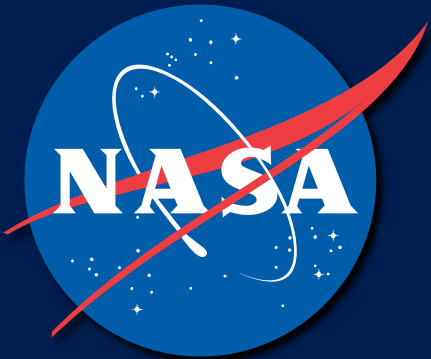
## **ARSET Air Quality Applications Webinar**

Adam Voiland, Science Writer  
Science Systems and Applications, Inc.

[adam.p.voiland@nasa.gov](mailto:adam.p.voiland@nasa.gov)

@avoiland

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# Mission

The Earth Observatory's mission is to share with the public the **images**, **stories**, and **discoveries** about the environment, Earth systems, and climate that emerge from NASA research, including its satellite missions, in-the-field research, and models.

# What we do

- Image-based: “magazine style” storytelling for the web
- Daily still imagery and maps
- Daily coverage of newsworthy natural hazards (includes several categories that are relevant to air quality: haze events, wildfires, dust, volcanic eruptions)
- Feature length stories
- Social media



# earthobservatory.nasa.gov

- 705k visitors/month
  - 7.9M visitors
  - 22.9M pageviews
- 79k email subscribers
  - 3 newsletters
- 6.5 million Facebook followers
- 434k twitter followers

The screenshot displays the NASA Earth Observatory website interface. At the top, the navigation bar includes the NASA logo, 'EARTH OBSERVATORY', and links for Home, Images, Global Maps, Features, News & Notes, and a search function. The main header features the 'Image of the Day' for September 23, 2013, showing a satellite view of Samarkand, Uzbekistan, with a brief description and a 'Read more' link. Below this, there are buttons for 'GRID VIEW' and 'EXPLORE ALL'. The left sidebar contains a 'Features' section with a featured article 'Dusting the Virtues of Snow' and a 'Natural Hazards' section with a grid of recent images. The right sidebar includes a 'Subscribe Today' button, a 'Climate 365' link, and a 'Blog' section with recent posts. The bottom of the page features a 'Global Maps' section with various thematic maps and a footer with social media links and contact information.



# Earth Science Missions and Instruments

- Formulation
- Implementation
- Primary Ops
- Extended Ops

Altimetry-FO (Formulation in FY16)

Earth Science Instruments on ISS:

RapidScat, CATS,  
LIS, SAGE III (on ISS), TSIS-1, OCO-3,  
ECOSTRESS, GEDI,  
CLARREO-PF



# Key Air Quality Resources from EO

- Natural Hazards Section

<http://earthobservatory.nasa.gov/NaturalHazards/>

- Image of the Day coverage

<http://earthobservatory.nasa.gov/IOTD/>

- Global Maps

<http://earthobservatory.nasa.gov/GlobalMaps/?eocn=topnav&eoci=globalmaps>

- Feature coverage

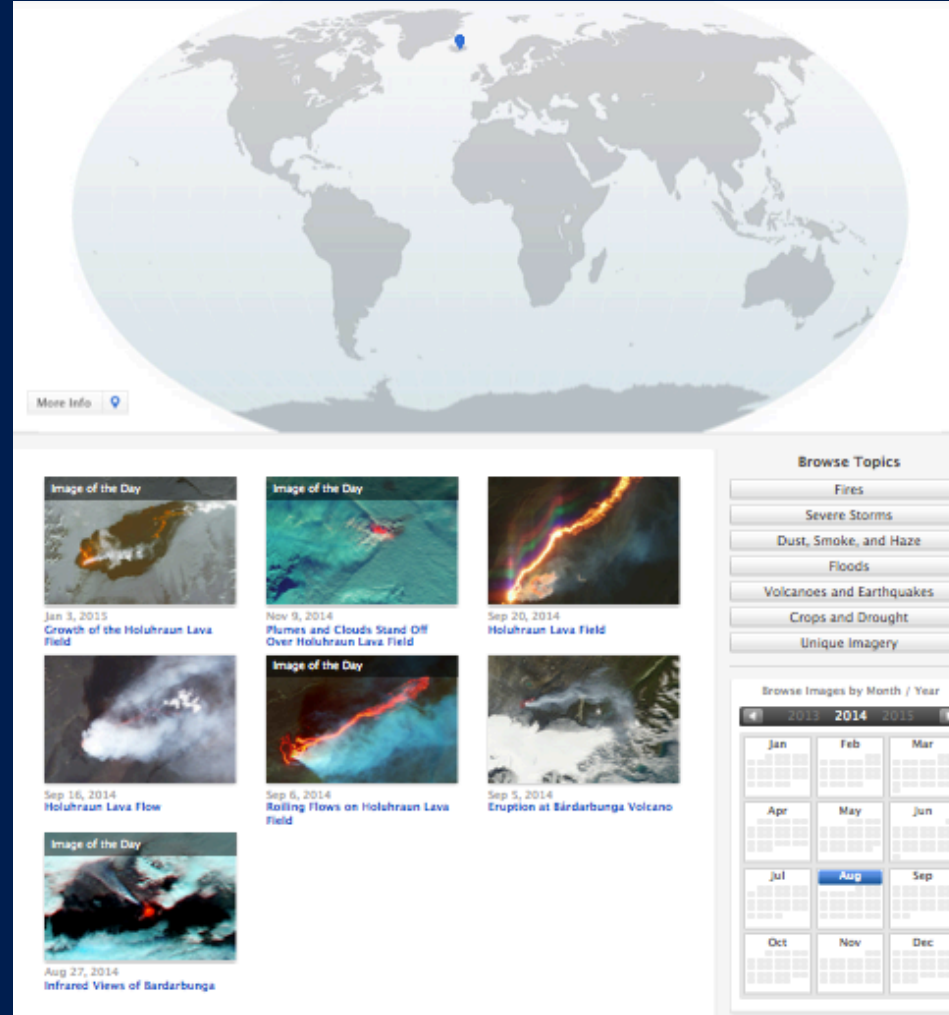
<http://earthobservatory.nasa.gov/Features/>

# Natural Hazards Section

- Timely, breaking news. Usually imagery no more than a few days old
- Divided into sections: 1) fire 2) dust, smoke haze 3) volcanoes
- Goal of at least one new hazards image per day
- Straightforward, succinct captions.

# Hazards Example: Holuhraun Eruption

- Event galleries
- Updated as we go with imagery from different sensors/datasets

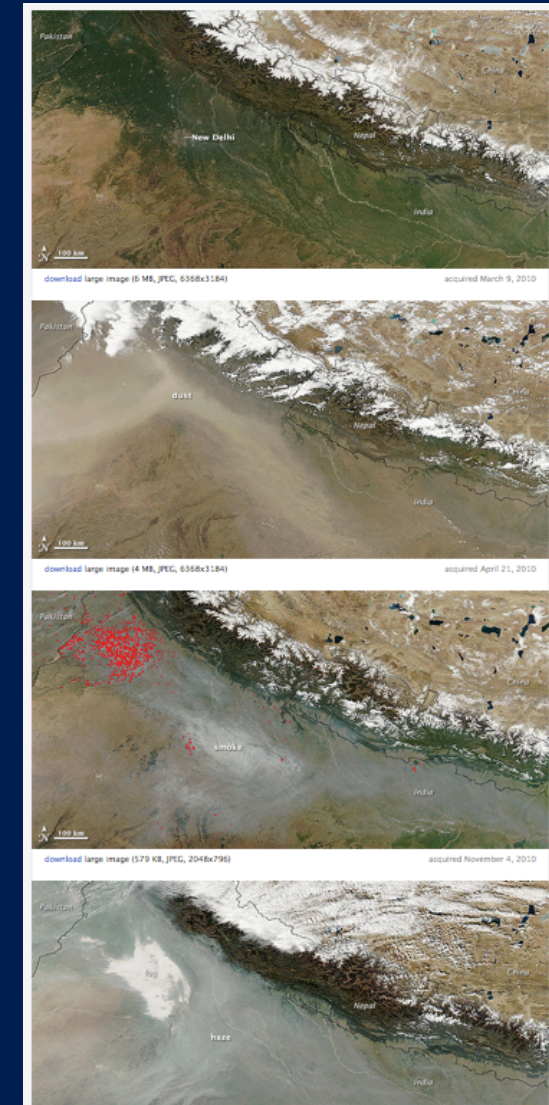
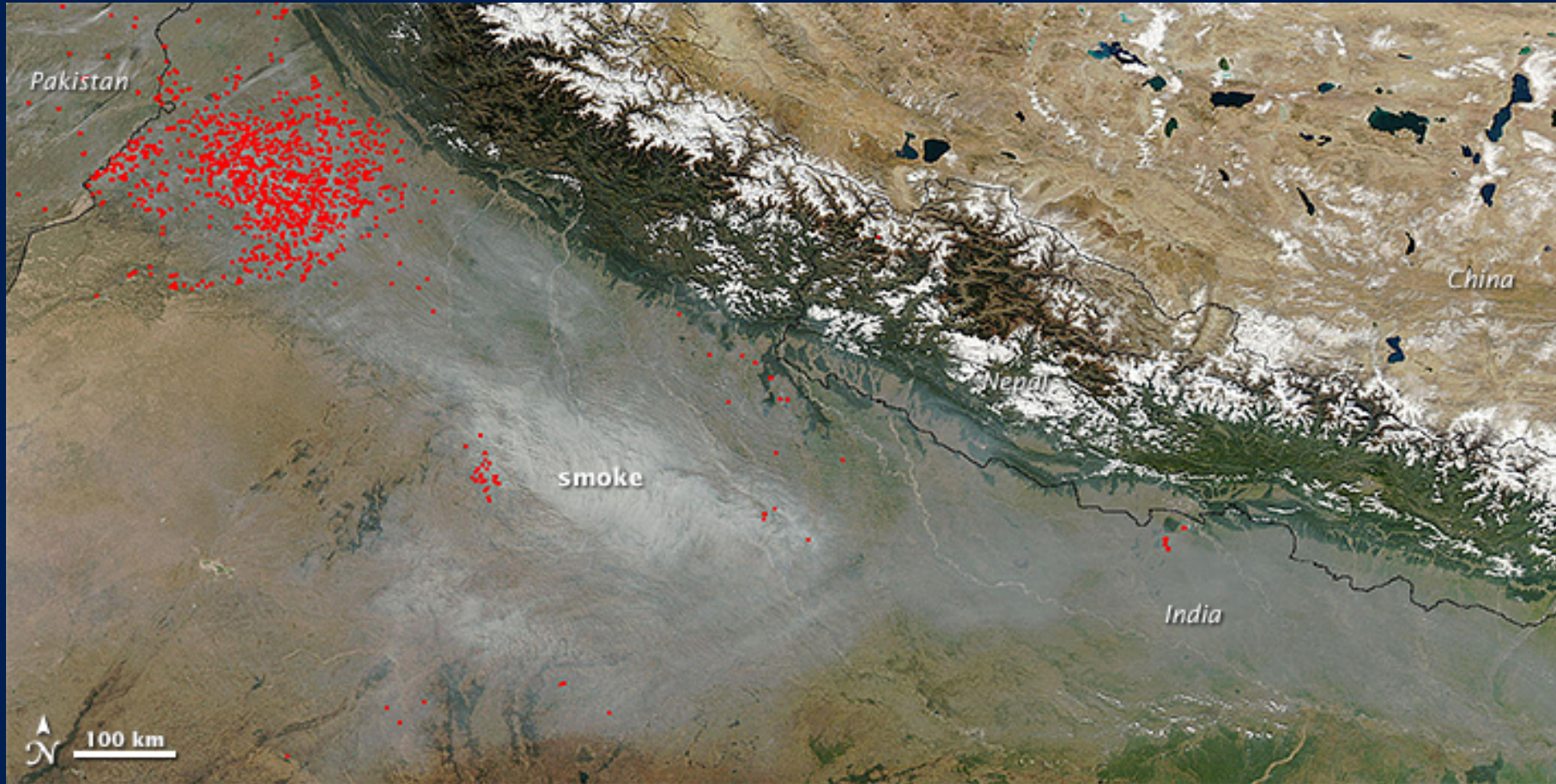


# Image of the Day

- Deeper stories. Often multi-image.
- Common data sources: MODIS on Aqua/Terra, OLI on Landsat 8, VIIRS on Suomi NPP, CALIPSO, OMI.
- Usually reported stories that include several references and links to sources of data.
- Examples: Seasons of air quality in India, New map of PM2.5, ship tracks in NO2



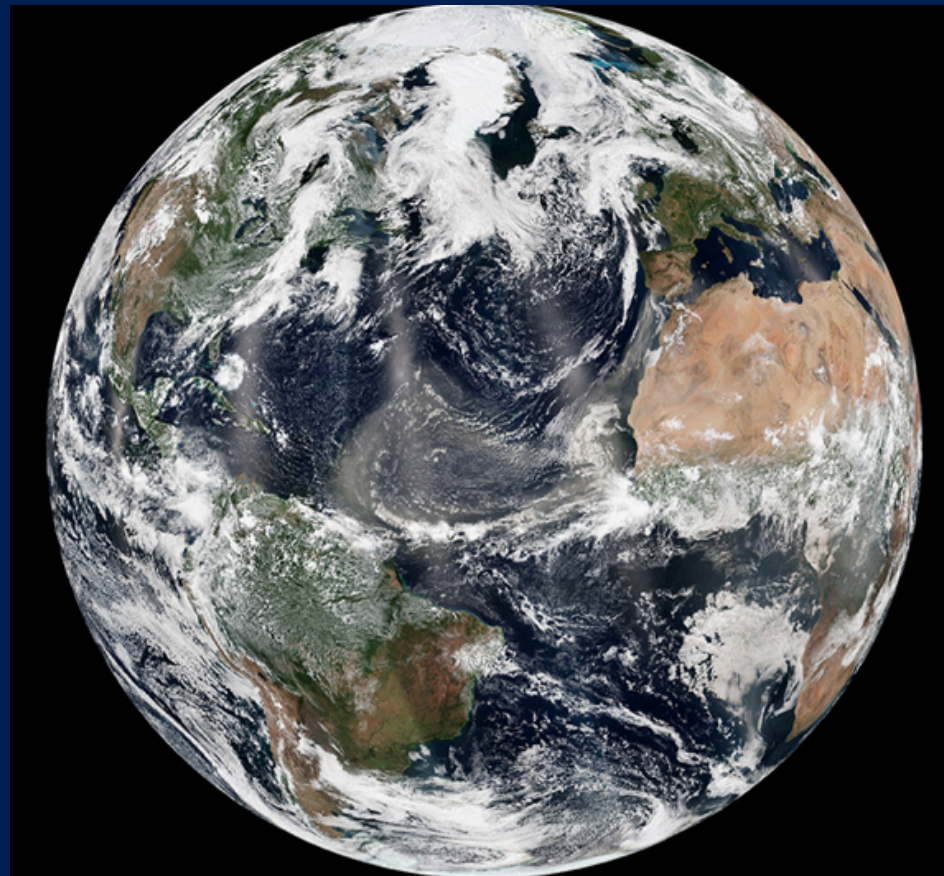
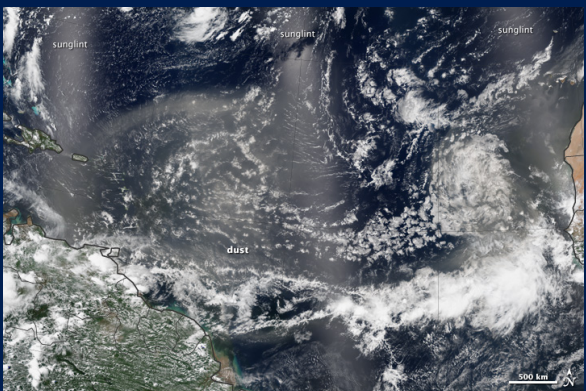
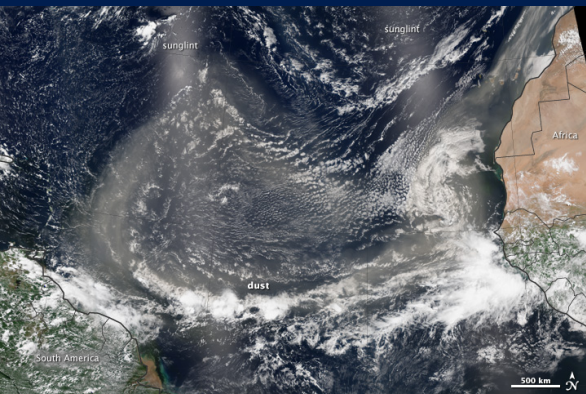
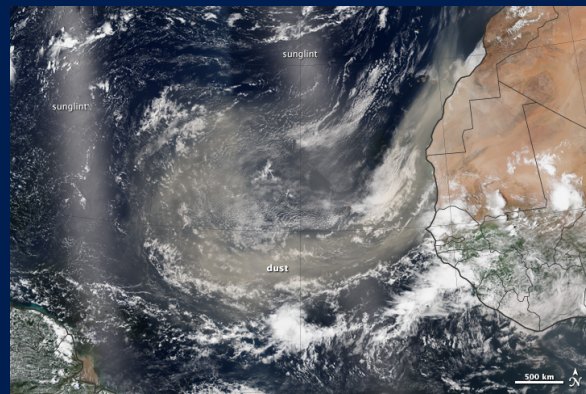
# Example: Seasons of Indian Air Quality



MODIS, 2014 <http://earthobservatory.nasa.gov/IOTD/view.php?id=84731>

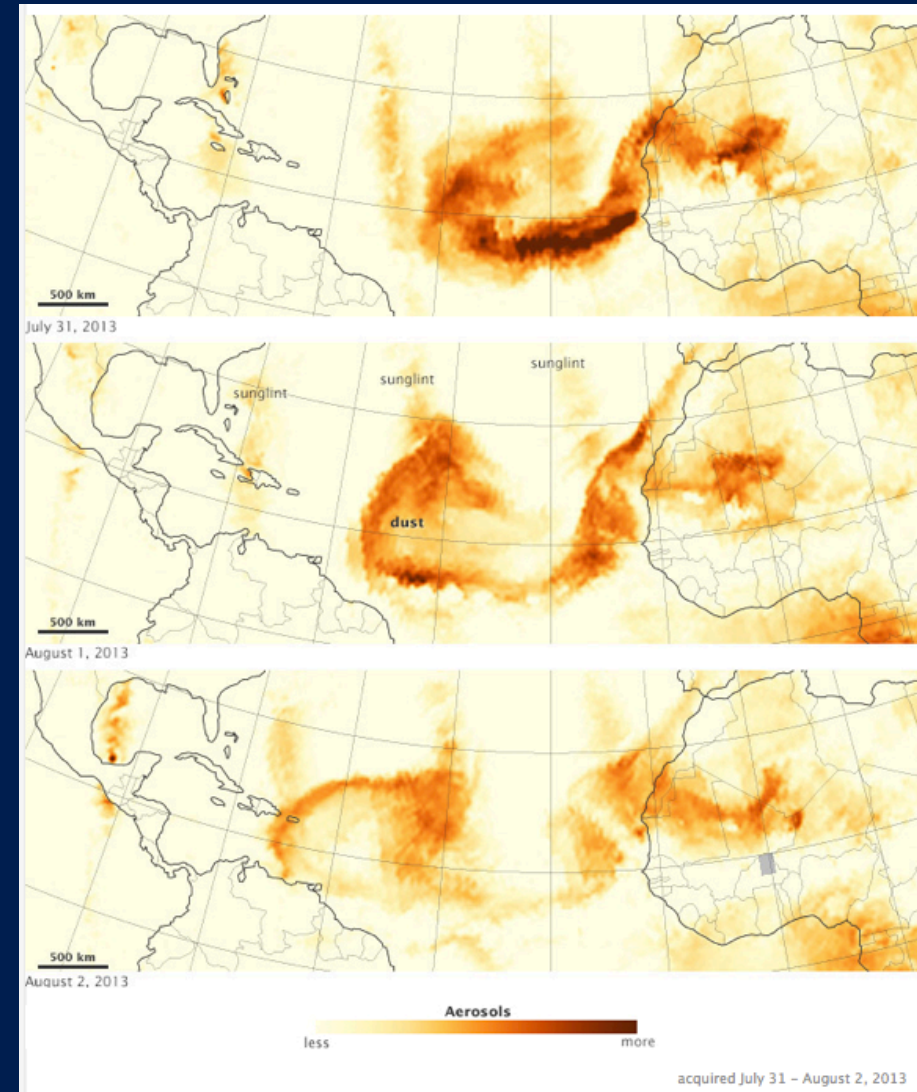


# Example: Dust Crossing the Atlantic



[download large image \(3 MB, JPEG, 3750x3750\)](#)

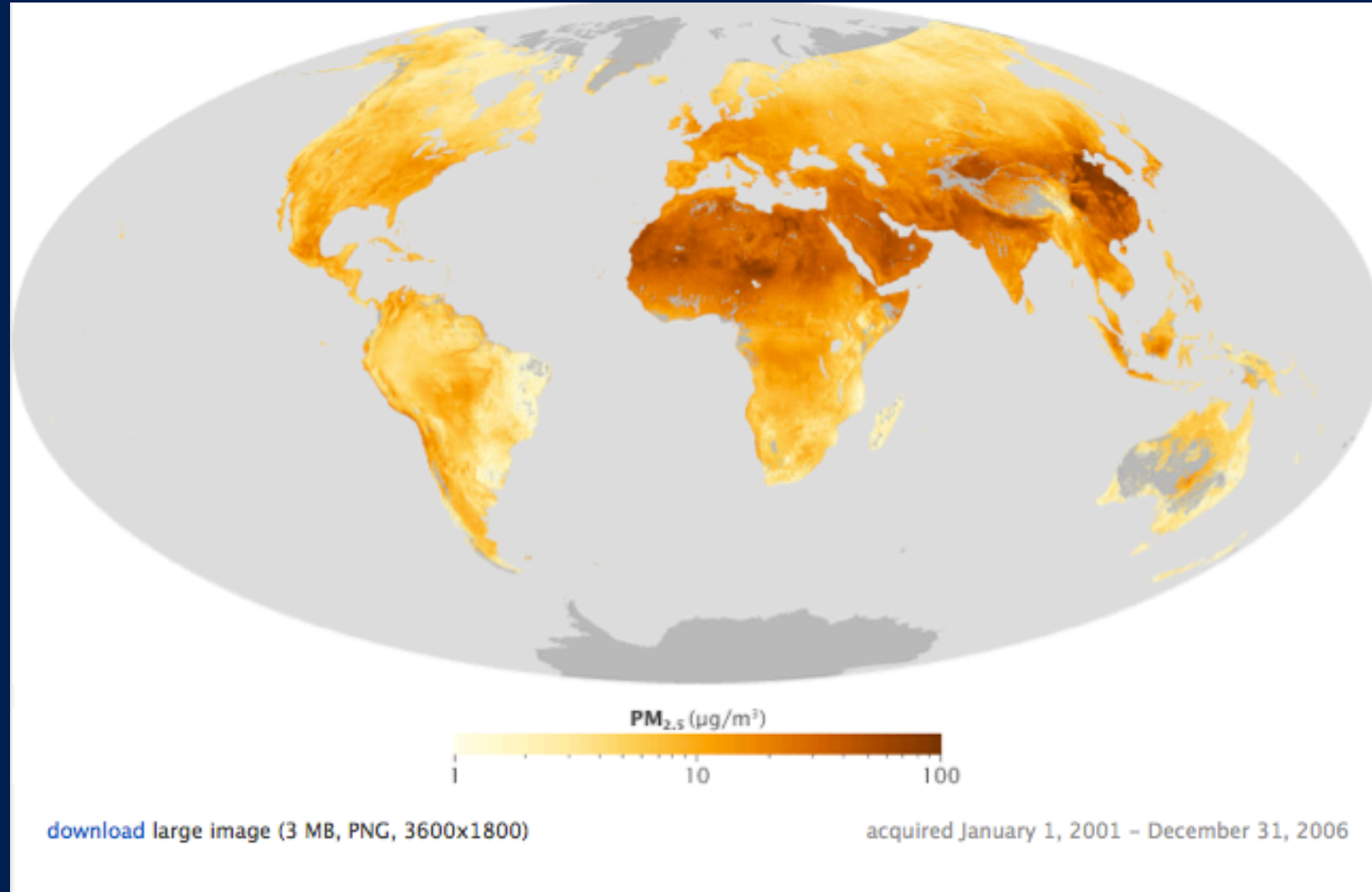
acquired August 1, 2013



VIIRS, OMI, 2013 <http://earthobservatory.nasa.gov/IOTD/view.php?id=81864>



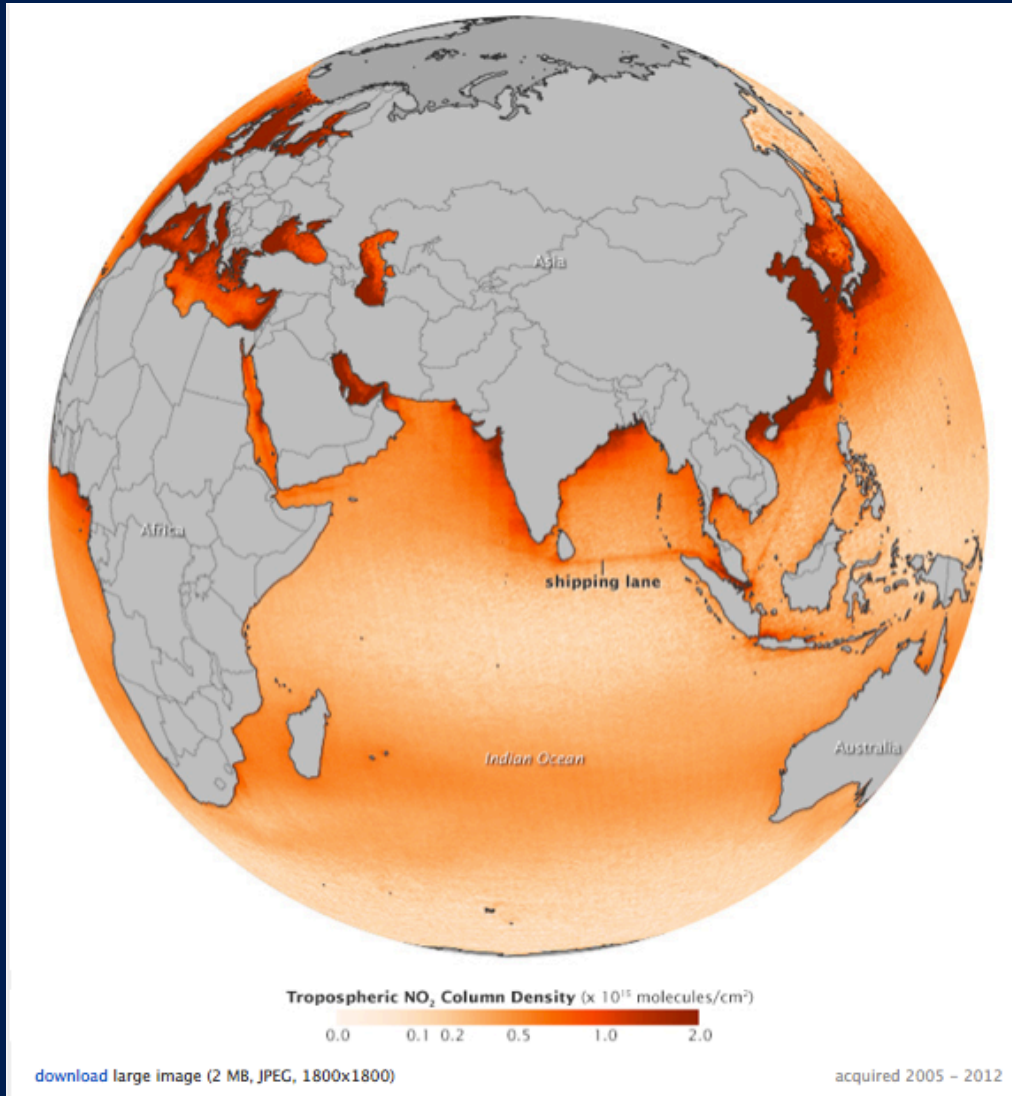
# Example: New Map of fine PM<sub>2.5</sub>



<http://earthobservatory.nasa.gov/IOTD/view.php?id=84731>

Based on MODIS, MISR data. Analysis by van Donkelaar et al, 2010 <http://ehp.niehs.nih.gov/0901623/>

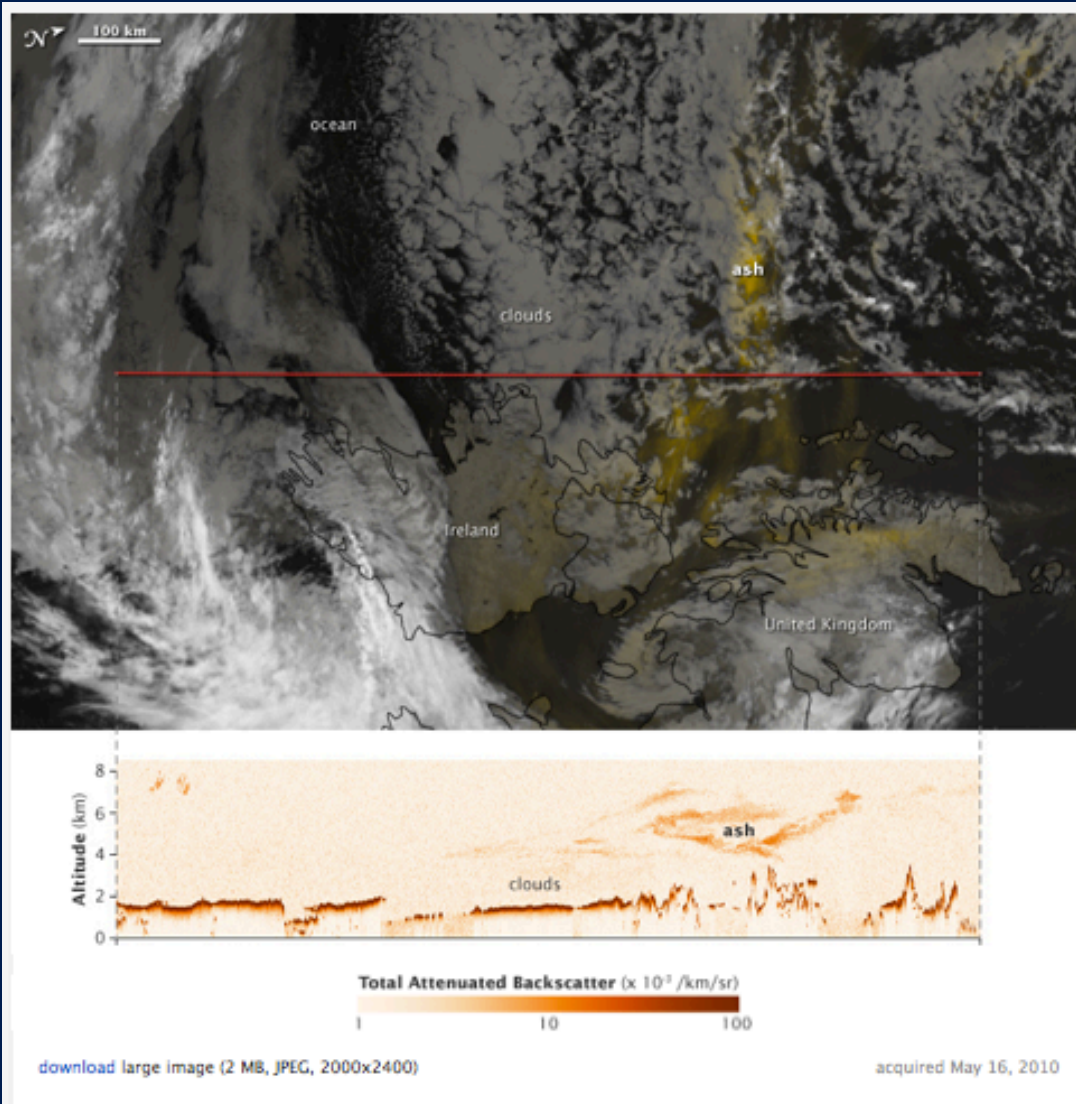
# Example: Shipping Pollution Map (NO<sub>2</sub>)



OMI, 2005-2012

<http://earthobservatory.nasa.gov/IOTD/view.php?id=80375>

# Example: Ash tracking with CALIPSO



Eyjafjallajökull Volcano, 2010

MODIS, CALIPOP

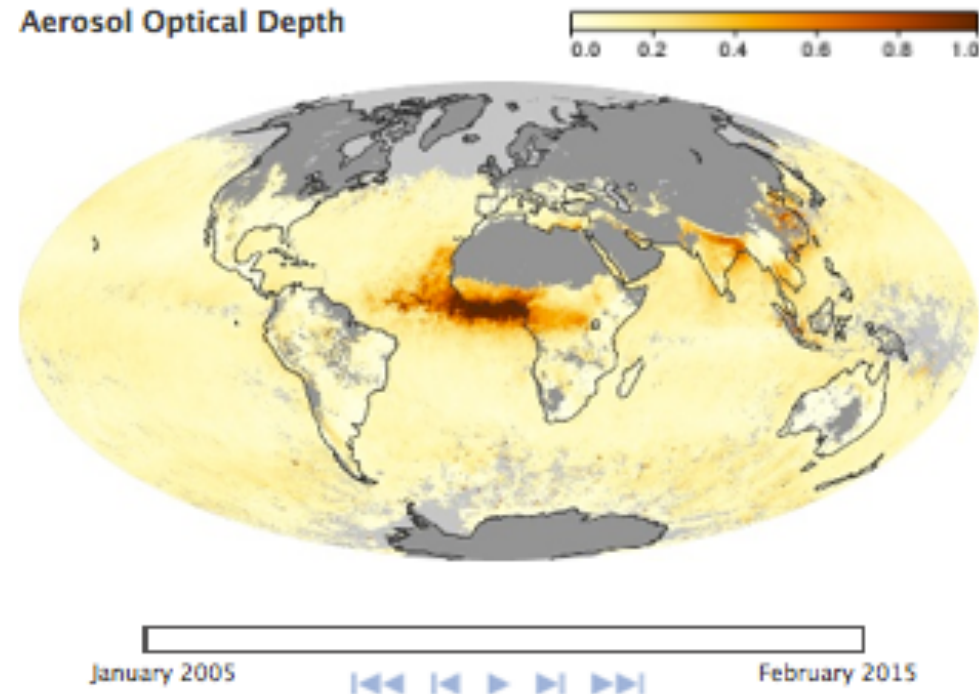
<http://earthobservatory.nasa.gov/IOTD/view.php?id=44052>

# Global Maps

- Regularly updated global maps of key NASA datasets relevant to air quality
- Presented as monthly averages.
- Quicktime animations include several years of data.
- Datasets include: aerosol optical depth (Terra MODIS), aerosol size (Terra MODIS), carbon monoxide (Terra MOPITT), fire (Terra MODIS)

# Example of Global Map: Aerosol Optical Depth

MODIS, 2005-2015, monthly  
[http://  
earthobservatory.nasa.gov/  
GlobalMaps/view.php?  
d1=MODAL2\\_M\\_AER\\_OD](http://earthobservatory.nasa.gov/GlobalMaps/view.php?d1=MODAL2_M_AER_OD)



[Download a Quicktime animation of this dataset \(5 MB\)](#)

Tiny solid and liquid particles suspended in the atmosphere are called aerosols. Windblown dust, sea salts, volcanic ash, smoke from wildfires, and pollution from factories are all examples of aerosols. Depending upon their size, type, and location, aerosols can either cool the surface, or warm it. They can help clouds to form, or they can inhibit cloud formation. And if inhaled, some aerosols can be harmful to people's health.

# Features

- Broad overviews. Intended for non-experts.
- 1) Aerosols: Tiny Particles, Big Impact (Primer)

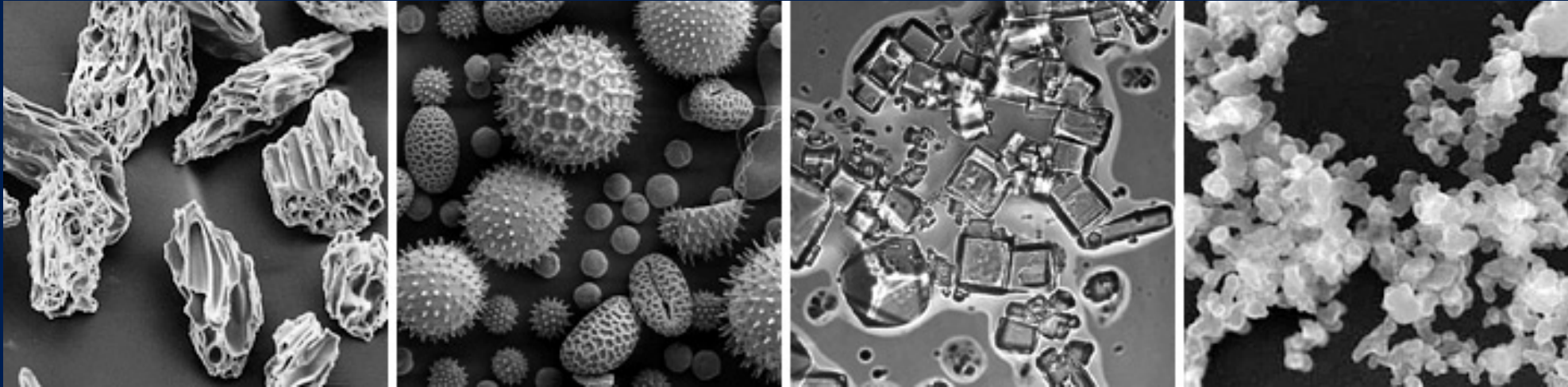
<http://earthobservatory.nasa.gov/Features/Aerosols/>

- 2) Air Quality: A Clearer View of Hazy Skies (Aerosol Trends)

<http://earthobservatory.nasa.gov/Features/AirQuality/>



# Aerosol Feature



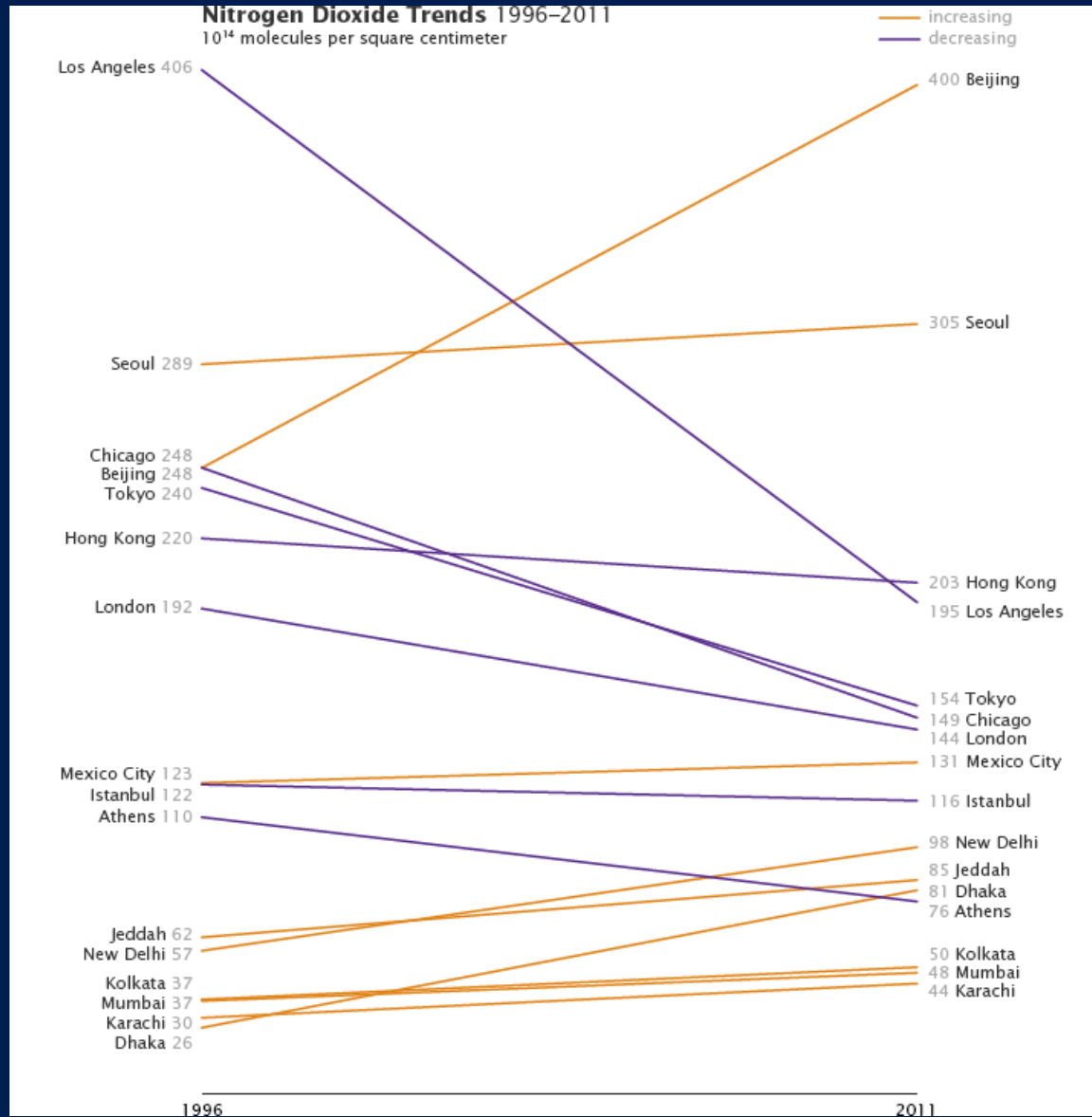
These scanning electron microscope images (not at the same scale) show the wide variety of aerosol shapes. From left to right: volcanic ash, pollen, sea salt, and soot. [Micrographs courtesy USGS, UMBC (Chere Petty), and Arizona State University (Peter Buseck).]



Desert dust, volatile organic compounds from vegetation, smoke from forest fires, and volcanic ash are natural sources of aerosols. (Photographs copyright (left to right) [Western Sahara Project](#), [Jonathan Jessup](#), [Vox](#), and [Ludie Cochrane](#).)



# Air Quality Trends Feature



Nitrogen dioxide pollution increased strongly over cities in China, the Middle East, and India from 1996 to 2011. Western Europe, the United States, and Japan showed decreasing amounts over the same period. Monthly data shows these changes in more detail. [Graph by Robert Simmon, data provided by A. Hilboll/University of Bremen (Hilboll et al., 2013)]

# Social Media

- 2-3 updates on Facebook per day
- 5-6 updates on Twitter per day (@NASA\_EO)
- Also on Google+, Instagram, Flickr, YouTube
- Facebook especially popular in Asia.
- 1.6 million from India, 350K from the Philippines, 250K from Pakistan, 220K from Bangladesh, 89k for Nepal. (Compare to 760K for USA)

# NASA Earth Observations (NEO)

- Repository of global data imagery
- 185k images from 50+ datasets/parameters
- Includes aerosol optical depth, carbon monoxide, aerosol particle radius, ozone.
- Choose time period and download imagery. Designed for educational purposes, not research.
- <http://neo.sci.gsfc.nasa.gov/>



# Other Resources

- MODIS Rapid Response Gallery

<http://rapidfire.sci.gsfc.nasa.gov/gallery/>

- EOSDIS Worldview

<https://earthdata.nasa.gov/labs/worldview/>

- Earth Explorer (Landsat, EO-1)

<http://earthexplorer.usgs.gov/>

# Notes from the Field 2014

- Want to blog for us?
- Wordpress. Plug and play. Easy to use.

Past missions include:

- South Pacific Bio-optics Cruise
- Greenland Aquifer Expedition
- NASA in Alaska (G-LiHT, MABEL)
- Ship-Aircraft Bio-Optical Research (SABOR)
- LARGE (The Langley Aerosol Research Group Experiment)
- Hurricane and Severe Storm Sentinel (HS3)
- Operation IceBridge: Antarctic



# Thank you. Questions?

[adam.p.voiland@nasa.gov](mailto:adam.p.voiland@nasa.gov)

@avoiland

# Facebook

- 6.5M likes [836k]
- 322M total reach
- 707 posts (2-3/day)
- Avg post reach: 455k

